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Research Report

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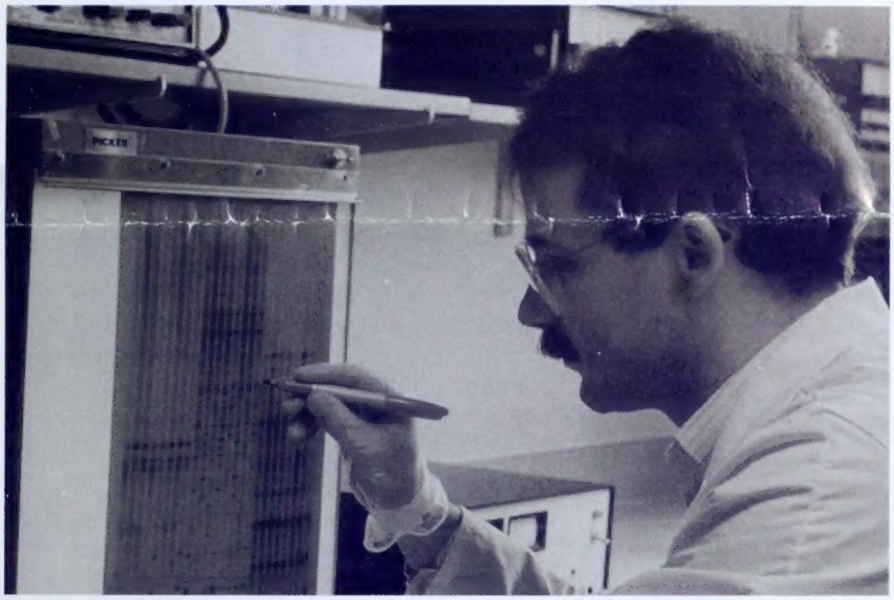

Researcher at the Veterinary Infectious Disease Organization sequencing a gene.

Battling Animal Diseases With Biotechnology

Saskatoon Institute First to Attempt Vaccination with DNA

The **Veterinary Infectious Disease Organization (VIDO)** in Saskatoon is celebrating its twentieth anniversary this year. VIDO has much to celebrate. An autonomous research institute situated on, and part of, the University of Saskatchewan, VIDO has compiled an impressive body of research results. Original capital funding for VIDO facilities was from the Government of Alberta and the Devonian Foundation.

Recognized as a Centre of Excellence, VIDO is at the international forefront in fighting animal diseases and enhancing animal performance. "In fact, we are more well-known abroad than at home," says Dr. Lorne Babiuk, VIDO's Director. **VIDO licensed the world's first genetically engineered vaccine, *PneumoStar*.**

In recent years, VIDO has jumped to the research front with its work on genetically engineered vaccines. According to Dr. Babiuk, "We were among the first, if not **the** first, organization to recognize the importance of biotechnology in our research." This very important research instrument has focused special attention on VIDO for its work in developing vaccines produced with the aid of biotechnology.

Technology transfer is a very important second step in VIDO's mission. Dr. Babiuk continues, "We want to be certain that the results of our research are transferred quickly to the farm so producers can realize profits. Since we ventured into this area, an extremely important goal of ours has been to speed up the process of making vaccines commercially available."

Alberta's leading research and coordinating agency, the **Alberta Agricultural Research Institute (AARI)**, has funded a number of diverse VIDO projects. Nearly $3.5 million in support has been provided by AARI since 1988. The Institute's Executive Director, Dr. Ralph Christian, states, "The livestock industry in Alberta represents about one-half of total agriculture and food industry revenues. Research in this sector is thus crucial. AARI has and continues to support research and technology transfer that will strengthen this vital industry in its profitability and competitiveness."

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A new project funded by AARI and conducted by Dr. Babiuk, "**Improved Vaccination Regimes Using DNA**", may revolutionize animal disease prevention. DNA is the genetic blueprint of life and determines all characteristics in plants and animals. Dr. Babiuk explains how DNA injection results in immunity: "By injecting DNA directly into the animal, the animal cells take up DNA and produce antigen (a substance, when introduced into the body, stimulates the production of protective antibodies). In this way, the animal acts as a 'bio-reactor' to produce vaccine in its own body. The animal then recognizes this antigen and develops immunity against invading micro-organisms."

One project objective is to DNA-immunize calves at a very early age. In theory, this will 'double-protect' the calf, since the mother's antibody also protects the calf. However, maternal antibody is effective for only three to four months. During that time, the DNA will have had time to 'kick in' and establish immunity in the animal.

Dr. Babiuk continues, "We are hoping this type of immunization will be life-long. Traditional vaccines, produced in laboratory mammalian tissue cultures, only last so long. This necessitates a costly booster program. If our goals are met, we will have discovered a cheaper and safer method of immunization. Reduced use of antibiotics is expected."

Another benefit would be elimination of adjuvants (ingredients that increase vaccine effectiveness). Presently, all killed vaccines require adjuvants, some of which are mineral oil based. Mineral oil is undesirable since it can cause local scarring in some animals. "We expect, however, that North America will, as in Europe, attempt to ban all mineral oil adjuvants," says Babiuk.

VIDO is the only organization of its kind in Canada, and among the world leaders battling animal diseases and improving livestock performance. Together with the **Western College of Veterinary Medicine** in Saskatoon - at which many Alberta veterinarians are trained - they form a leading-edge resource centre for Alberta and a vital part of the Alberta agriculture infrastructure. Innovative projects such as Dr. Babiuk's DNA immunization study should continue to benefit Alberta's agriculture and food industry for many years to come.

RESULTS TO DATE

Immunization of mice and cattle with DNA shown to be effective.

POTENTIAL BENEFITS

- Major economic loss from animal diseases reduced by lower mortality and handling costs.
- Elimination of chemical aids (example, mineral oil) used in traditional vaccines.
- Application to other livestock, and, possibly, humans.

Focus Groups Identify Research Opportunities

Workshops are organized under the Institute's **Focus on Research Opportunities Program** to explore opportunities for Alberta's farm commodities and processed products. The program was formerly known as the Agricultural Research Reviews Program.

Invited workshop participants identify research opportunities as ways of overcoming challenges facing Alberta's main agricultural commodities, resources and disciplines. Diverse groups representing various public, private and academic organizations and companies are invited to discuss and pinpoint research needs in a focus-group format.

AARI sponsored separate dairy and poultry workshops on April 19, 1995. The dairy session was held in the morning and poultry in the afternoon.

The dairy focus groups were each assigned a topic, including: cow nutrition, feed energy, animal welfare, abortion control and new processed products.

Focus groups in the poultry session dealt with issues such as: environmental and nutritional concerns; diseases, safety, quality and animal welfare; breeding; and new products.

An extensive list of needs and opportunities were generated by both dairy and poultry participants. They are valuable to the Institute for coordinating and priorizing its support for agricultural research.

Dairy and poultry recommendations are summarized in separate documents. Copies may be obtained from Research Division, Alberta Agriculture, Food and Rural Development, #202, 7000-113 Street, Edmonton AB T6H 5T6. Phone (403) 427-1956. Fax (403) 427-3252.

Increase Phosphorus Uptake: Increase Profits

Researchers Identify Slow-Release Technology

Researchers examine young, healthy barley plants on soil enriched with slow-release phosphorus.

Most cultivated soils in the prairie provinces are deficient in phosphorus (P), a major nutrient required by cereals, oilseeds and other crops. Phosphorus fertilizer is nearly as costly as nitrogen. The problem is that only 5-20% of the P is taken up by the plant.

Researchers from the University of Alberta (Dr. Marvin Nyborg) and Alberta Agriculture, Food and Rural Development (Elston Solberg) teamed up to tackle the problem. The research was supported by AARI's Farming for the Future Research Program, project: "Marked Increase in Plant Availability of Applied Phosphate Granules."

According to Elston Solberg, "In a typical year, we see a poor phosphorus uptake of 15-20%. Our slow-release experiments demonstrated that uptake can easily be doubled or tripled by coating the fertilizer granules with a polymer. This slows down nutrient release and dramatically increases uptake and yield.

We knew the slow-release granules would be effective, based on early experiments, in which granules were covered with perforated shrink-wrap film. The mechanical slow release greatly improved phosphorus uptake, however, simple polymer coating seemed the most practical technique. It is now used with nitrogen fertilizer."

Solberg concludes, "The project has been a good example of teamwork. In addition to the university and our department working together, we have had technical assistance from individuals helping us produce the coated granules. Coated granules are not presently available on a commercial scale but we expect they will be soon."

The project results certainly have worldwide implications, aside from benefits to Alberta and Canada. The research continues (for a major fertilizer company) on ways to improve the efficiency of phosphorus fertilizers with effective polymer coatings.

RESULTS TO DATE

Statistically-significant increase in phosphorus availability to crops, by coating fertilizer granules with slow-release polymers.

POTENTIAL BENEFITS

- Increased profitability from higher yield and lower input cost.
- Phosphate reduction in the environment.

Dateline

Events

September
Announcement of **Beef Industry Development Fund** project approvals.

November 1
Deadline for new research proposals under the following AARI programs:

Farming for the Future Matching Grants

Farming for the Future Direct Funding

Research Coordination

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TechTransfer

Transferring the farm

Successful farm succession. This is the major goal of a 1994 project funded under AARI's **Farming for the Future On-Farm Demonstration Program**.

About one-third of Alberta farmers are over the age of 55. This age sector represents roughly $1.5 billion in farm cash receipts. Efficient and smooth farm transfer through generations is thus critical to future profitability.

According to Mr. George Rock, an Alberta Agriculture, Food and Rural Development farm management specialist in Leduc, the project uses 'grounded theory' to pinpoint farm transfers that have proven to be successful. He explains, "We use a qualitative approach, by first interviewing people involved in smooth successions. Our method is called 'snowball sampling', where we conduct interviews one at a time, after having reviewed the previous taped interview."

Mr. Rock continues, "If we are to be sustainable in the farming sector, we absolutely need sustainable transfers. However, there are a multitude of factors affecting transfer. They fall under 3 main categories: Family, Farm and Individual. Under individual, for example, a significant factor is age and illness. This is one of few, if any, attempts at applying the research to farm families. Based on our first 4 interviews, we expect to contribute in some way to farm profitability."

RESULTS TO DATE

Valuable information obtained from families who have successfully transferred farms.

POTENTIAL BENEFITS

Increased farm profitability resulting from successful transfer information, by training farm managers.

Editorial

In the Spring 95 issue of *Research Report*, I introduced the notion of biotechnology as an indispensable research tool, and certainly not confined to agriculture. Increased literature and media exposure of biotechnology has demonstrated it not only to be gaining widespread acceptance, but also essential in order to keep pace with rapid technological changes in the world.

Despite a concerted educational approach to this complex area, there are many who fervently oppose its use, primarily on the basis of moral and safety issues.

To address safety aspects of biotechnology, the federal health department issued in September 1994, in two volumes, *Guidelines for the Safety Assessment of Novel Foods*. Canada's *Food and Drugs Act* regulates, through pre-market notification and assessment, many food safety issues, such as pesticide residues, food additives and the use of ionizing radiation. Until the recent guidelines, however, information has not been required on novel foods or novel processes such as biotechnology.

Volume II of the guidelines deals exclusively with genetically modified micro-organisms and plants. Proposed regulations pertain to concerns such as: development and production of the modified organism or plant; product information; dietary exposure; nutritional data; and toxicology data.

Biotechnology/genetic engineering is a valuable research aid. It helps keep our agriculture and food industry competitive at home and abroad. It is certainly not an unregulated 'willy-nilly' tactic used to toy with life forms or create health and environmental hazards.

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